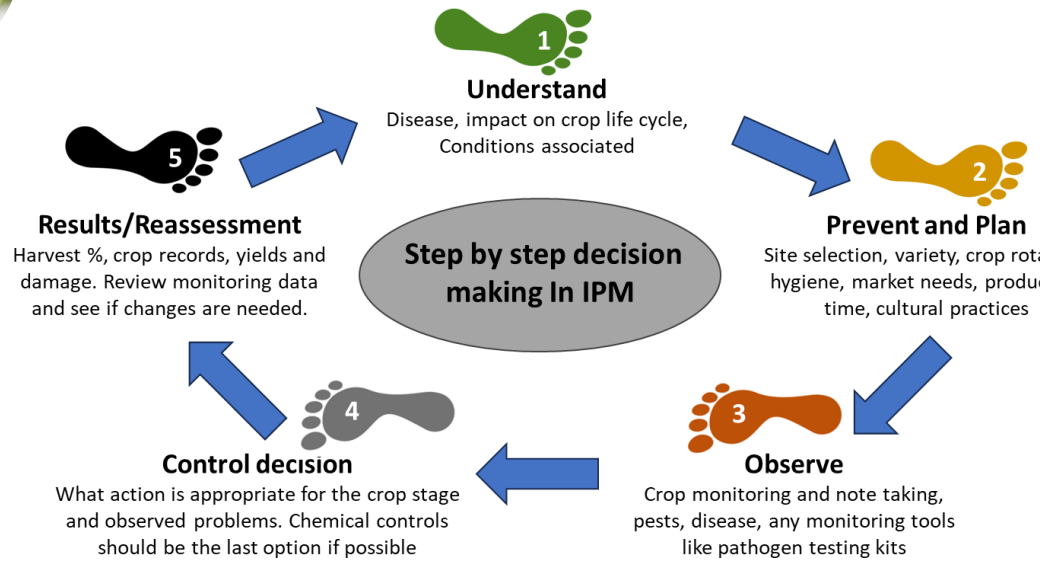
Diseases in salad crops

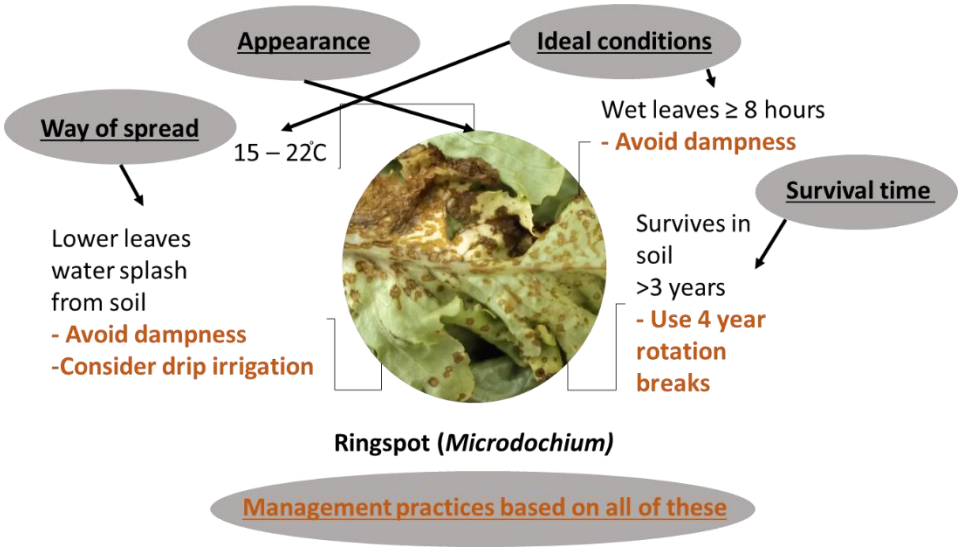
Salad crops have a great market for growers of various sizes and situations. Whilst many species may benefit from indoor growing, there are several varieties with different conditional requirements to take advantage of in producing a mixed salad-bag crop.

Salad crops can in many instances be fragile and susceptible to damage and disease, having to discard or trim heads, due to unsightly disease, not only hits profits but is disheartening after the effort put in to producing a crop.

Diseases are a key 'pest' in horticultural food production which can lower your yields, impact your profits and make your business less sustainable and resilient. More and more we need to use the principles of 'Integrated pest management' (IPM) to help us deal with these problems.



<u>Understand</u> - There are a vast range of diseases that can impact your salad crops, so, to provide some context, this factsheet discusses aspects you should think about for lettuce.
The key things you need to know to help you plan for any salad crop, include understanding the diseases:



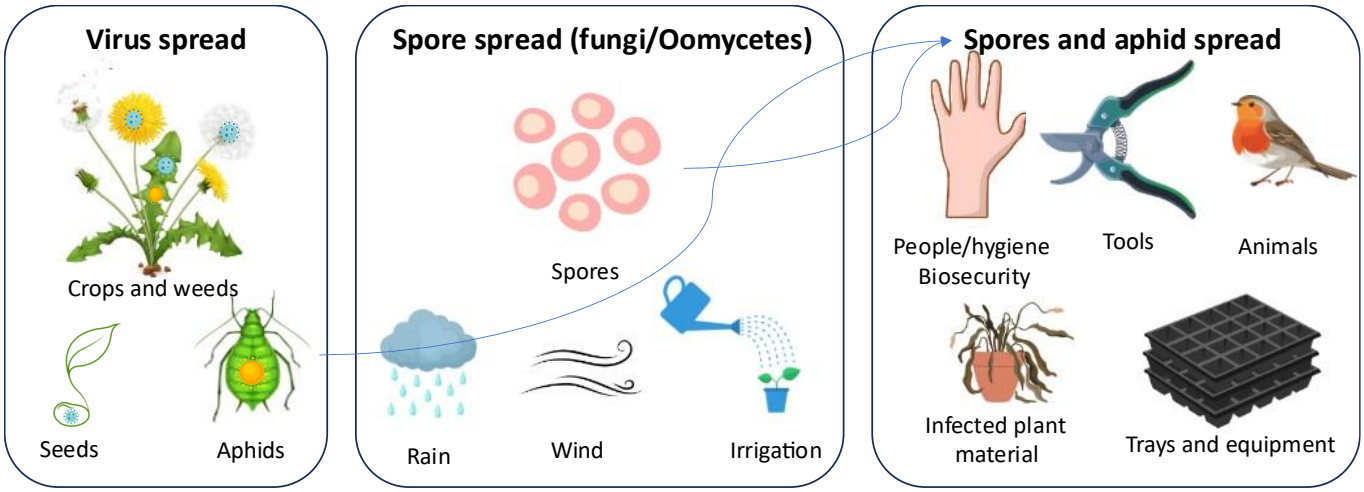
Common myths! – Fungi and many other pathogens require water, so thoroughly drying off equipment and storage containers removes contamination risk.

INCORRECT

Pathogens can have resting spores which survive well in dry conditions including species like *Botrytis, Pythium and Fusarium*

Information relating to other diseases can be found at the end of the factsheet.

Aside from spreading through soil, or your growing substrate, there are above ground spreading pathways that you need to think about in order to manage disease effectively. These are important for viruses, fungi and oomycetes. What is also important is to assess your plant nutrients to ensure that you aren't mistaking nutrient deficiencies for diseases.



Prevent and plan – A plant is like you! Providing it with a good environment, keeping it fit, balancing its nutrition, lowering its stress and nurturing it makes it more resilient to disease and infection.

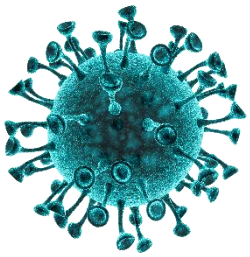
Site selection - There is a risk to your salad crops from its substrate, via pathogens that can last over 10 years in some cases, in soils, or in poorly stored substrates (or even old substrate containers and trays). This makes it important to pick a 'clean' site and maintain a 'clean' working environment, whether that is outdoors, or protected. But there are also 'good' microbes present in soils that can help with nutrient levels and protect plants via competition with the 'bad' microbes.

Outdoor – provides free rain but also a variety of environmental risks. When planting outdoors soil health is key.

- Look for soil with lots of pores and fissures to aid drainage, aeration, root growth & biological activity.
- Compaction is an issues, if you can pick a clump of soil and hand mould it its too wet and working on it will likely cause compaction.
- Increasing soil organic matter will improve water holding capacity and earthworm activity.
- Consider the use of manure, green manure and digestate solids but source them carefully to standard such as PAS100/110 to avoid contamination and use them within determined nitrogen limits.
- Consider using cover crops to improve soils and supress weeds between cropping rotations.
- If soils have a good structure consider min or zero tillage, you may need some tillage initially to achieve good structures in poorer soils.
- Always avoid ploughing or leaving diseased crop materials on your soil surface.

Protected - harvest conditions are easier and can reduce damage to your product. However, protected sites need cleaning of pests and disease (pressure washing, disinfecting) and being enclosed, this can lead to humidity build up, that favour's diseases. It can be worth considering automated vent control to avoid this. Other considerations include space. Planting extremely close together, to increase crop numbers, can facilitate the ease of disease spread and lead to losses of yield overall – **this requires careful consideration!**

Virus protection – A key aspect of protection is against viruses. Once you have a virus present in your system there are no specific control products available. Preventing viruses is therefore key and it can help too;



- Plant crops away from older crops, ideally upwind
- Ensure you have weed-free planting beds, to remove other plants and aphids as virus reservoirs
- Monitor and control for aphids
- Pull up, burn or otherwise dispose of infected crop plants - Adhering to legislation at all times

Observe and Results – Monitoring crops and disease occurrences and patterns can be key. Looking backwards can help you to move forwards and implement control decisions based on the results and reassessment of a previous IPM decision cycle. it can help too;

- Keep records of disease problems
- Record effectiveness of control measures
- Identify if there are hot-spots
- Record dates and conditions as they appear
- Identify if some varieties are healthier than others
- Learn from problems and don't repeat mistakes

Control decisions - There are several control decisions related to different diseases and pests.

Pre-emptive control decisions

- Hygiene, biosecurity measures (soil on boots etc)
- Ensure any manures are fully composted
- Minimise or quarantine transplants
- Bioprotectant drenches pre sowing
- Sterilise soil (only feasible in certain systems)
- Check breeders lists for resistant crop varieties

Symptomatic control decisions

- Remove and destroy infected materials
- Clean and disinfect all facilities and equipment
- Apply chemical pesticides but ensure you rotate modes of action over time to avoid resistances
- Some organic pesticides are available that have reduced impacts on harvest delays

Remember! – Protectants stop diseases occurring but don't help already diseased crops

Some useful products and the pathogens they target;

Product	Type	Pathogens
Amylo-X	Protectant bio-fungicide	Varius Plant fungi diseases including powdery mildew
Prestop	Protectant bio-fungicide	*Didymella, Botrytis, Pythium, Phytopthora, Rhizoctonia and Fusarium*
Trianum	Protectant bio-fungicide	*Pythium, Rhizoctonia and Fusarium*
Serenade ASO	Protectant bio-fungicide	Varius Plant fungi diseases

Common myths! – Storing propagation trays and equipment outdoors overwinter to kill pathogens in the cold.

INCORRECT

Many pathogens, particularly fungi, can survive freezing conditions for years at a time, it is more important to disinfect your materials and store them somewhere clean for next use or disinfect prior to use

Resources

Approved pesticides | Pesticide manual online | Irish guidance IPM
Diseases of lettuce crops | Outdoor salads crop walkers guide | IPM lettuce
Horticulture introduction guide - including pathogen control

Disease	Appearance	Ideal conditions	Way of spreading	Survival time	Management practices
Fungi					
Ringspot (*Microdochium)*	Brown lesions – centres may drop out	Cool and wet 15-22^{o}C	Soil to leaf via irrigation	>3 years	• Avoid dampness • Consider drip irrigation • 4 year break cycle • Use resistant varieties
Fusarium wilt and rot (*Fusarium oxysporum)*	Reddish necrosis in main root leading to wilt	Warm soil 24-28^{o}C mostly some new strains down to 8^{o}C	Soil, seeds and other plants	>4 years	• Avoid root wounds • 5 year break cycle
Bottom rot (*Rhizoctonia solani)*	Brown spots midrib and mycelial threads to soil	Leaf wetness and warm 25-27^{o}C	Wind, water and soil	3-10 years	• Minimum 4 year break cycle -avoiding crops that can host pathogen (carrots, radish etc) • Soil distance to leaf a factor so upright varieties less impacts or use raised beds
White mould (*Sclerotinia)*	Watery soft lesions with a white mycelium	Moist cool soil 13-18^{o}C	Wind, water ,soil and airborne spores	3-10 years	• Minimum 4 year break cycle – 400 host plants so hard to rotate safely • Avoid proximity of health to disease plants
Grey Mould (*Botrytis cinerea)*	Brown blotches or rotting of older leaves or severe stem rot. Mases of grey spores	Moist wet and cool conditions	Damaged tissue, Airborne spores and spread from weeds		• Handle transplants carefully • Avoid injuring plants • Avoid sites with poor drainage • Avoid deep planting
Oomycetes					
Damping-off (*Pythium)*	Pre and post emergence seedling death	Varies depending on species some favour cool other warm	Water and wind/dust	>10 years in soil	• Plant in raised beds • Don't overwater • Use transplants not direct seeding
Downy mildew (*Bremia lactucae)*	Pale-green lesions with downy spores on underside of leaves	Moist cool soil 20-22^{o}C	Airborne spores and soil oospores		• Plant varieties of salad leaves to ensure some thrive • Avoid humidity
Viruses					
Lettuce big vein virus	Vein-clearing, leaf bubbling and stunted growth	Cool wet soil <16^{o}C	Seeds and seedlings + some weeds like thistle	>10 years	• Plant on raised beds • Don't overwater • Avoid planting in cool temperatures
Cucumber mosaic virus (CMV)	Stunted plants with necrotic spots		Seed, weeds and aphids		
Lettuce mosaic virus (LMV)	Chlorotic mottling		Seed, weed and aphids		
Turnip yellow virus (TuYV)	Interveinal yellowing		Cross plant from beets, spinach and other brassicas and aphids		